REMARKS

In the Office Action claims 1,5,7, and 8 were rejected under 35 U.S.C. 103(a) as unpatentable over Irons et al. (5,983,876) in view of Tuttle (SAE 800794). Claims 2-4 were rejected as unpatentable over Irons et al. in view of Tuttle and further in view of Carey et al. (6,021,758) claims 1 and 6 were rejected as unpatentable over Irons et al. in view of Tuttle. Reconsideration is requested.

The Tuttle SAE papers which were cited in the Office Action, and were published about 24 years ago, provide excellent reviews of the basic concepts of operation of an engine with late intake valve closing or early intake valve closing. The papers disclose the fact that these concepts provide many benefits but are in general not applicable to operation of automotive engines in the higher load ranges. Instead operation with late or early intake valve closing is generally possible only in the low or mid load range of engine operation. Since the time of the Tuttle papers considerable work by researchers and engineers has resulted in the development of engines which are in or expected to soon be in production, utilizing the concepts of the Tuttle papers.

Under these circumstances, one might expect that obvious advances or improvements to the subject matter disclosed by Tuttle would by now have been made public or brought to fruition in developed engines using this operating method.

However, the disclosure of the present application provides at least two features which are not found in the cited prior art and which are pertinent to the question of obviousness of the present invention. First, the instant disclosure points out, possibly for the first time, that substantial load unbalance between the cylinder banks of a V-type engine is considerably more likely to occur in engines when using, for example, late intake valve closing than in engines with conventional valve timing where in the intake valve opens and closes near opposite ends of the piston intake stroke. The conclusion is then stated that controlling camshaft position with cam phasers during late or early intake valve closing "may still result in a power unbalance between the engine cylinder banks of

up to as much as seven or eight percent in cases of operation in the late or early closing modes" (see application, paragraph 16).

The disclosure then indicates that these power unbalances may be corrected as needed by the method set forth in the application of sensing the instantaneous crankshaft speeds or accelerations during the power strokes, computing their averages for each bank in order to determine the degree of difference, or unbalance, between the banks, and then adjusting the cam phaser for at least one of the banks to obtain equal averages of the crankshaft speeds or averages of each bank.

The invention improves operation of engines with late or early intake valve closing with a minimum of cost by utilizing the cam phasers and crankshaft position sensors already utilized on engines of the type described in order to determine the amount of unbalance and then correct it by adjusting one or both of the cam phasers already on the engine. If this relatively simple concept had been obvious to those skilled in the art, it would seem surprising that there is not some disclosure of this concept in the available prior art. However, no such disclosure is currently known. Accordingly, it is submitted that the method described in claim 1 and the other claims of the present invention was not, as the Office Action concludes, obvious to those skilled in the art at the time and, therefore, constitutes patentable subject matter. On this basis, withdrawal of the rejections of claims 1-8 and allowance of these claims is requested.

As a second reason, it is submitted that the rejections of the claims appear to rest on some misunderstandings of the disclosures of the references cited. For example, 5;983,876 Irons et al., which is relied upon in rejection of all the claims, fails to disclose the features of sensing a crankshaft rotational characteristic during the power strokes of pistons of predetermined comparable cylinders of each bank and computing average crankshaft rotational characteristics for the power strokes of the comparable cylinders as the Office Action alleges. Instead, Irons et al. teaches sensing the exhaust temperatures of separate banks of the engine and comparing them to generate a

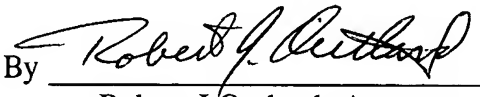
difference which is then corrected by adjusting the fuel rate to one of the cylinder banks to obtain equal exhaust temperatures indicative of equal power output.

The additional reference 6,021,758 Carey et al. cited with respect to claims 2-4, apparently relies upon a calculation through a Fourier transform of engine speed data to provide a basis for determining unbalance between the cylinders. However, this does not clearly involve Applicants' method of averaging speed or acceleration values obtained from instantaneous readings during the cylinder power strokes and averaging these values for the respective cylinder banks.

Accordingly it is submitted that the combined references fail to disclose the specific method recited in claims 1 and its dependent claims 2-8 or to provide a basis for disclosure of either the problem or the solution which would make the present invention obvious. Accordingly, reconsideration of the rejections and allowance of claims 1-8 are respectfully requested.

This amendment is believed to be fully responsive to the issues raised in the Office Action and to place this case in condition for allowance. Favorable action is requested.

Respectfully submitted,

By 

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